APPENDIX C
ECONOMIC ASSESSMENT
FOR THE
DREDGED MATERIAL MANAGEMENT PLAN (DMMP)
MILWAUKEE HARBOR, WISCONSIN

Appendix C
Economic Assessment

List of Tables

Introduction

The Milwaukee Harbor long-term disposal study was initiated in 1993 under the Authority of Section 123, P.L.91-611. Policy and procedures regarding development, review, approval and implementation of Dredged Material Management Plans (DMMP) are established in Appendix E, paragraph 15 of the Planning Guidance Notebook (ER 1105-02-100). Unfortunately, this ER gives little guidance on performing an economic assessment. In subsection b of said paragraph, this ER states:

> For many projects with readily available maintenance and usage information, a preliminary assessment, based on indicators such as annual O&M costs per ton of cargo, volume and frequency of traffic, and vessel dimensions, may establish the Base Plan and confirm that continued maintenance appears to be warranted[1].

The purpose of a typical DMMP economic assessment is to compare the economic indicators used to originally justify the Project with the current estimates of said indicators. This comparison is done to determine the effects of changes in maintenance dredging of the Project. Ultimately, the economic assessment is used to justify, or to not justify, continued maintenance dredging.

However, cases occur in which the authorizing document was completed so long ago that it either lacks discussion of economic indicators, or said discussion bares little resemblance to current economic conditions. In such cases, the DMMP economic assessment is forced to evaluate the effects of changes in maintenance dredging using the best available data.

As ER 1105-02-100 does not identify required outlines or table formats for an economic assessment, this analysis mostly follows those found in the draft EC 1165-2-200 (National Harbors Program: Dredged Material Management Plan) dated July 21, 1994.

Project Description

The following is a brief description of Milwaukee Harbor and its facilities. For a more detailed Project description, including maps, see section 1 of the Main Report. Milwaukee Harbor is located on the west shore of Lake Michigan in the city of Milwaukee, Wisconsin, about 85 miles north of Chicago, Illinois. Milwaukee Harbor is a deep draft harbor at the confluence of the Milwaukee, Menomonee, and Kinnickinnic Rivers. The authorized project at Milwaukee Harbor has two segments, consisting of an outer and inner harbor. The outer harbor stretches approximately 3.5

[1] Found on page E-71 of ER 1105-02-100.

miles and is situated between the Harbor's breakwaters, located approximately 3,000 feet offshore, and the shoreline. The inner harbor extends the commercial navigation channel to portions of the Milwaukee, Menomonee, and Kinnickinnic Rivers, as well as the South Menomonee and Burnham Canals. The entrance channel into the inner harbor is formed by piers on the north and south sides of the channel.

Milwaukee Harbor has approximately 16 deep-draft facilities currently operated by private firms and the Port Authority. Thirteen facilities are located in the outer and inner harbor, while the others are situated on the Kinnickinnic, Milwaukee and Menomonee Rivers. Each facility has access to rail lines operated by the Union Pacific Railroad and the Canadian Pacific Railway.

Benefit Indicators

The authorizing legislation for the construction of navigation features and dredging at Milwaukee Harbor spans from August of 1852 to October of 1962. Considering the lack of reliable commodity and vessel data for the majority of this 100-year-plus time span, a typical comparison of economic indicators will not be performed. Instead, this assessment will describe past and current trends in commodity and vessel traffic for Milwaukee Harbor, comparison of these trends with those experienced across the Great Lakes region, and future traffic projections.

Commodity Traffic - Milwaukee Harbor is primarily a receiving port; 87.2% of traffic is inbound. The outbound commodities are primarily farm products (wheat, corn and soybeans), sand and gravel. The primary inbound commodities are non-metallic minerals, coal lignite, cement, concrete, asphalt, tar and pitch.

Table C-1 details the shipped tonnage of each of these commodities groups as found in the Corps' *Waterborne Commerce of the United States, Part* 3- *Waterways and Harbors Great Lakes*. The table covers years 2001 through 2005, the latest year for which the Corps has released data. Table C-1 also details the percentage of total tonnage each commodity represents.

Taken together, these six commodities groups make up roughly 95% of traffic through Milwaukee Harbor. Over the five-year period, non-metallic minerals have decreased in relative importance while coal lignite, cement and concrete have increased. The particular non-metallic mineral in this case is road and other de-icing salts. Approximately 60-70% of the State of Wisconsin's roadways use salt brought in through the Harbor. Salt traffic dipped sharply in 2002, but has been rising since. The inbound coal is barged inland to three area power plant. This commodity has fluctuated over the period but remained essentially stable until 2005 when it experienced a sharp increase. Concrete and cement are used in southeastern Wisconsin's construction industry and have risen steadily over the period. Taken together, these three commodity classifications account for approximately 75% of the cargo shipped through Milwaukee Harbor. Although of relatively less importance, asphalt, tar and pitch have increased slightly. This commodity group is used in various construction and industrial applications. The two outbound commodity groups, farm products and sand and gravel have decreased slightly.

Table C-1
Commodity Classification
Milwaukee Harbor
2001-2005
(in thousands of short tons)

	Non-Metallic Minerals	Coal Lignite	Cement & Concrete	Farm Products	Asphalt, Tar & Pitch	Sand & Gravel	All Commodities
2001	1,147	770	661	365	164	97	3,373
Percent	*34.0%*	*22.8%*	*19.6%*	*10.8%*	*4.9%*	*2.9%*	
2002	680	787	816	474	209	60	3,127
Percent	*21.7%*	*25.2%*	*26.1%*	*15.2%*	*6.7%*	*1.9%*	
2003	742	674	867	277	143	106	3,002
Percent	*24.7%*	*22.5%*	*28.9%*	*9.2%*	*4.8%*	*3.5%*	
2004	812	733	904	238	174	92	3,156
Percent	*25.7%*	*23.2%*	*28.6%*	*7.5%*	*5.5%*	*2.9%*	
2005	911	1,156	963	317	189	79	3,805
Percent	*23.9%*	*30.4%*	*25.3%*	*8.3%*	*5.0%*	*2.1%*	
Average	*26.0%*	*24.8%*	*25.7%*	*10.2%*	*5.4%*	*2.7%*	

Source: Waterborne Commerce of the United States

Aggregate commodity traffic at Milwaukee Harbor is presented in Table C-2. Data for years 1985 through 2005 are found in the Corps' *Waterborne Commerce of the United States, Part* 3- *Waterways and Harbors Great Lakes*. Data for 2006 was reported by Milwaukee Harbor in April, 2007.

One characteristic of the presented data is that commodity traffic in 1993 is relatively equal to that in 1985 and represents a change in traffic trends at the Harbor. From 1985 through 1992, traffic generally exhibited a downward trend, decreasing by roughly 330,000 tons (-13.5%). From 1993 through 2006, traffic generally exhibited an upward trend, increasing by roughly 1.3 million tons (52.2%).

The years 2005 and 2006 represent a large increase in commodity traffic at the Harbor. These years are either short-term increases from the average trend or long-term increases. If these years are short-term increases, the resulting analysis will be biased in favor of justifying maintenance dredging. Subtracting the years 2005 and 2006, traffic from 1993 through 2004 increased 660,000 tons (26.4%), so even if these years are short-term increases, commodity traffic at Milwaukee Harbor is clearly rising, In a further attempt to examine the data without possible biasing from years 2005 and 2006, Table C-2 also shows three-year traffic averages from 1993 through 2004. Note that three years is an arbitrary choice and is not meant to represent any economic or technological situation. Excluding years 2005 and 2006, the data show that the three-year average has increased approximately 336,000 tons (12.2%).

Table C-2
Aggregate Commodity Traffic
Milwaukee Harbor 1985-2005

Year	Traffic	3-Yr Averages
1985	2,490	
1986	1,823	
1987	2,161	
1988	2,289	
1989	2,379	
1990	2,128	
1991	2,076	
1992	2,153	
1993	2,496	
1994	2,641	
1995	3,140	**2,759**
1996	2,858	
1997	3,265	
1998	3,108	**3,077**
1999	3,531	
2000	3,539	
2001	3,373	**3,481**
2002	3,127	
2003	3,002	
2004	3,156	**3,095**
2005	3,805	
2006	3,800	

Source: Waterborne Commerce of the United States

Operations and Maintenance Cost per Ton - As stated in paragraph E-15 of ER 1105-02-100, the operations and maintenance cost (O&M) of the Project per ton of commodity shipped can be used to justify continued maintenance of the Project.

A more detailed discussion of historic O&M costs is presented later in this analysis. For the immediate purpose, it is noted that Milwaukee Harbor is not dredged every year, but rather every three to five years on average. Dredging has not occurred at the Harbor since 2001 and the amount dredged in that year was abnormally small. For these reasons, it appears that using the average of O&M costs over several years for calculating the ratio of costs per ton is more appropriate. Table C-3 presents the costs of dredging and environmental sampling which have occurred at the Harbor since 1995. The table also lists total commodity tons shipped through the Harbor in those same years. Finally, an average O&M cost per commodity ton is derived.

Table C-3
Operation and Maintenance
Cost per Commodity Ton
1995 – 2006

Year	Dredging Cost[1]	Environ. Samp. Cost[1]	Total Cost	Tonnage Shipped[2]	O&M Cost per Ton
1995	$ 355,717	$ 0	$ 355,717	3,140,000	
1996	$ 0	$ 0	$ 0	2,858,000	
1997	$ 0	$ 0	$ 0	3,265,000	
1998	$ 0	$ 0	$ 0	3,108,000	
1999	$ 829,728	$ 0	$ 829,728	3,531,000	
2000	$ 0	$ 0	$ 0	3,539,000	
2001	$ 28,736	$ 0	$ 28,736	3,373,000	
2002	$ 0	$ 47,934	$ 47,934	3,127,000	
2003	$ 0	$ 0	$ 0	3,002,000	
2004	$ 0	$ 0	$ 0	3,156,000	
2005	$ 0	$ 0	$ 0	3,805,000	
2006	$ 0	$ 0	$ 0	3,800,000	
12-year Average			**$ 105,176**	**3,308,666**	**$ 0.32**

[1] Costs in FY07 dollar values.
[2] Measured in short tons.

<u>Great Lakes Commodity Comparison</u> - As many more types of commodities are shipped throughout the Great Lakes than are shipped through Milwaukee Harbor, a simple comparison of traffic tonnage will not yield any important information. Table C-4 details the increase/decrease in Great Lakes tonnage for the same commodity groups discussed in Table C-1.

Two points regarding these commodity groupings need to be noted. First, because non-metallic minerals is a NEC category (Not Otherwise Classified), it is somewhat of a "catch-all" category. At the port of Milwaukee, this category is almost, if not absolutely, exclusively road and other de-icing salts. Across the Great Lakes region, this category would also include other unclassified minerals. Secondly, as the major farm products shipped through Milwaukee Harbor are wheat, corn and soybeans, only these products are used in comprising farm produce for the Great Lakes region.

Table C-4
Great Lakes
Select Commodity Groups
2001-2005

	Non-Metallic Minerals	Coal lignite	Cement & Concrete	Farm products	Asphalt, Tar & Pitch	Sand & Gravel	**Total**
2001	6,323	42,475	6,740	6,299	1,248	7,550	**72,636**
2002	4,854	40,165	6,874	5,526	1,345	5,267	**66,033**
2003	5,544	39,982	7,102	4,511	1,171	6,253	**66,566**
2004	6,044	40,413	7,179	4,562	1,061	5,511	**66,774**
2005	5,771	42,365	7,140	4,607	1,011	4,696	**67,595**
Change in Tonnage over the Period	**-552**	**-110**	**400**	**-1,692**	**-237**	**-2,854**	**-5,041**
Percent Change	-8.7%	-0.3%	5.9%	-26.9%	-19.0%	-37.8%	-6.9%

Source: Waterborne Commerce of the United States

Table C-5 then compares the changes in Great Lakes traffic for these selected commodities to Milwaukee Harbor's.

Table C-5
Changes in Traffic Compared
Milwaukee Harbor and Great Lakes

	Milwaukee Harbor	Great Lakes
Non-Metallic Minerals	-20.6%	-8.7%
Coal lignite	50.1%	-0.3%
Cement & Concrete	45.7%	5.9%
Farm products	-13.2%	-26.9%
Asphalt, Tar & Pitch	15.2%	-19.0%
Sand & Gravel	-18.6%	-37.8%
Group Total	**12.8%**	**-6.9%**

Across the Great Lakes region, five of the six commodity groups in question have decreased, causing the total of these commodity groups to decline by 6.9%. For the same period, Milwaukee Harbor traffic has increased 12.8%. For four of these commodity groups, traffic at the Harbor and for the Lakes mirrors each other. The largest decreases across the Great Lakes region occur in the two commodity groups that Milwaukee Harbor exports, namely farm products and sand and gravel. Non-metallic minerals decreases across both the Great Lakes and Milwaukee, while cement and concrete both increase.

The most striking result of the comparison is that while across the Great Lakes, coal lignite is relatively static, Milwaukee Harbor has experienced an increase of 50.1% (386,000 tons). This implies that Milwaukee Harbor is becoming a more prominent shipper of Great Lakes coal, primarily due to increased cost of transporting coal by rail.

Future Traffic Projections - A search of available Corps reports reveals that no evaluations regarding traffic projections for Milwaukee Harbor have been performed. Yet, an argument for increasing traffic at Milwaukee Harbor can be made based on current traffic trends at the Harbor. This analysis has detailed that commodity traffic at Milwaukee Harbor has increased by 1.3 million tons over the last 14 years. This increase is caused by the supply and demand conditions in each of the commodities markets. An evaluation of these markets is beyond the scope of this analysis. At best, some generalizations can be made about these markets.

Several supply factors have lead to increasing traffic at Milwaukee Harbor, but only one is pertinent to this discussion, the advantage of waterborne transportation over rail transportation. For users that have access to both water and rail transportation in the Greta Lakes basin, waterborne transportation is relatively cheaper due to the economies of scale inherent to transporting greater amounts of cargo.

In 2005, the Tennessee Valley Authority (TVA) undertook an analysis for the U.S. Army Corps of Engineers to determine the costs of rail, trucking and water transportation for commodities shipped throughout the Great Lakes basin. TVA conducted interviews with ports, shippers and rail authorities to determine the origin and destination of commodities traveling on the Great Lakes. A specific commodity having a unique origin and destination was defined as a movement. TVA also surveyed port and shipping officials to estimate fuel, handling, storage, etc costs associated with cargo transportation. These costs were then modeled to obtain an average cost per ton for each movement. TVA then used an existing rail-costing model to determine the cost of shipping that same movement via rail. The result of this analysis was that waterborne transportation throughout the Great Lakes, and specifically at Milwaukee Harbor, is relatively cheaper than rail transportation. However, it should be noted this analysis assumed that the various industries will continue to utilize the same origin and destination in the event of a port closure. In certain cases, industries might engage in different actions, e.g. halting manufacturing, moving facilities, utilizing different suppliers, etc in the event of a port closure. Because the cost differential between waterborne and rail transportation assumes the same origin and destination, any such actions would bias the estimated cost differential upward. See the Works Cited page for more information on this study.

Also, in many cases, waterborne transportation is more available, due to increased rail congestion and capacity limitations[2]. It is safe to assume that these factors will not be easily ameliorated, causing water transportation to become relatively more appealing in the future.

For example, as transporting coal by rail has become more expensive, power plants in the Milwaukee area have increased the amount of coal shipped by water through the Harbor. From 2000 to 2005, the bulk of Milwaukee Harbor's inbound coal, roughly 672,000 tons on average, was shipped from Chicago Harbor, IL. In 2005, Milwaukee Harbor began receiving additional shipments of coal, approximately 290,000 tons, from Duluth Harbor, MN and Superior Harbor, WI. Table C-4 previously showed that coal shipments at Milwaukee Harbor increased by 50.1%, a direct result of increasing rail transportation costs[3].

Based on increasing railroad costs, railroad constraints and the increasing traffic trend of the last five years, it is safe to assume that commodity traffic at Milwaukee Harbor will experience moderate increases in future years.

Vessel Traffic – Based on data compiled by the US Army Corps of Engineers, the composition of the fleet servicing the harbor has changed slightly over the last ten years. *The Phase I Summary Report – Dredged Material Management Plan Study-Milwaukee Harbor Wisconsin*, dated December 1997 and prepared by the Detroit District US Army Corps of Engineers, detailed that most commodities were shipped by Class 5 vessels (600 feet to 649 feet in length). An examination of similar data for 2005 reveals that Class 8 vessels (731 to 849 feet) have gained equal prominence. Based on the 2005 data, Class 3 vessels (500-549 feet) are the smallest class utilizing the Harbor, while the previously mentioned Class 8 are the largest.

The drafts of the vessels servicing Milwaukee Harbor are displayed for the years 1991, 1995, 2001 and 2005 in Table C-6. These numbers represent the aggregate of inbound, outbound, foreign and domestic vessels.

The number of vessels reporting drafts of 26 feet or more increased from 39 in 1991 to 76 in 2005. Note that the authorized depth of Milwaukee's outer harbor and the entrance to the inner harbor is 28 feet and 27 feet at the mouth of the Kinnickinnic River (in the inner harbor). This indicates that shippers tend to load to the deepest draft possible to maximize cargoes and minimize transportation costs. The fact that in 1995, shippers used 5 vessels of 28-foot draft and 8 vessels of 29-foot draft, underscores that shippers seek to maximize vessel draft to reduce costs. Certainly, if the depth of the channels had permitted, shippers would have loaded to these deeper drafts in subsequent years.

---

[2] Great Lakes – St. Lawrence Seaway New Cargoes/ New Vessels Market Assessment Report, January 2007. Prepared by TEMS, inc and Rand Corporation for the U.S. Department of Transportation and Transport Canada. Section 5.4.

[3] The coal shipment information came from the U.S. Corps of Engineers Inland Navigation Planning Center. That the impetus of this shift was due to increased rail costs came from a conversation with TVA.

Table C-6
Vessel Traffic
Milwaukee Harbor
1991 - 2005

Draft	1991	%	1995	%	2001	%	2005	%
29	0	0.0%	8	0.1%	0	0.0%	0	0.0%
28	0	0.0%	5	0.1%	1	0.0%	0	0.0%
27	23	0.8%	11	0.2%	0	0.0%	37	2.2%
26	16	0.6%	14	0.2%	18	0.7%	39	2.3%
25	11	0.4%	14	0.2%	56	2.2%	11	0.7%
24	41	1.5%	55	0.8%	53	2.1%	68	4.1%
23	59	2.1%	23	0.4%	82	3.3%	91	5.4%
22	32	1.2%	47	0.7%	78	3.1%	59	3.5%
21	45	1.6%	59	0.9%	32	1.3%	42	2.5%
20	20	0.7%	22	0.3%	48	1.9%	57	3.4%
19	12	0.4%	51	0.8%	94	3.8%	37	2.2%
18	49	1.8%	47	0.7%	97	3.9%	73	4.4%
17	30	1.1%	29	0.4%	21	0.8%	39	2.3%
16	21	0.8%	67	1.0%	47	1.9%	132	7.9%
15	9	0.3%	21	0.3%	23	0.9%	48	2.9%
14	19	0.7%	24	0.4%	35	1.4%	3	0.2%
13	127	4.6%	45	0.7%	10	0.4%	72	4.3%
>12	2,245	81.4%	5,938	91.6%	1,795	72.1%	865	51.7%
Total	**2,759**		**6,480**		**2,490**		**1,673**	

Source: Waterborne Commerce of the United States

As it currently stands, many of the vessels reporting drafts of 26 feet or more are light-loaded because their mid-summer drafts exceed the authorized channel depth.

The most significant change over the 15-year period is the decrease in the number of vessels reporting drafts of 12 feet or less, 2,245 in 1991 compared to 865 in 2005. This represents a 61.5% decrease. Barges of 12-foot draft or less are used to transfer cargo from the deeper-draft vessels in the inner harbor to dock facilities in the upstream, shallower depth portions (21 feet) of the Project. A decrease in the use of these shallower-draft barges during a time period that has experienced growth in tonnage traffic indicates that shippers prefer to forgo transferring cargo when possible to lower transportation costs. Over the 15-year period, the number of vessels recording drafts of 16 to 21 feet has increased from 177 to 380, emphasizing this preference for deeper-draft vessels. However, this is only possible when the drafts of the inner harbor and upstream portions of the Project are sufficiently maintained.

Benefit Indicator Summary -

The benefit indicators for continued maintenance dredging are summarized in

Table C-7 on the following page. Based on the information and trends discussed above, it is expected that coal, concrete, cement, asphalt, tar, pitch and possibly non-metallic minerals will make up a larger percentage of aggregate traffic while farm products, sand and gravel will comprise a smaller percentage. Tonnage traffic is expected to increase moderately. Class 5 and 8 vessels will most likely continue to be the most common used at Milwaukee Harbor in the future. Also, it is expected that shippers in the inner harbor will continue to maximize draft whenever possible, resulting in fewer shallow barges used for transfer.

Note that the table only lists commercial navigation benefit indicators. Listings for recreation and commercial fishing benefit indicators are not presented in the table since this analysis does not attempt to quantify any such benefit.

Table C-7
Benefit Indicators

Benefit Indicators[1]	Current Operations[2]	Trend[3]	Summary/Remarks
Commodity Types			Although the absolute tonnage of asphalt, tar and pitch shipped through the Harbor has increased, its relative size of total traffic, as measured by percentage, has remained relatively static.
Coal	30.4%	Increasing	
Concrete & Cement	25.3%	Increasing	
Non-Metallic Minerals	23.9%	Decreasing	
Farm Products	8.3%	Decreasing	
Asphalt, Tar & Pitch	5.0%	Static	
Sand & Gravel	2.1%	Decreasing	
Tonnage			Although down from 2001 levels, Non-Metallic Minerals has experienced growth in each of the last four reported years.
Coal	1,156	Increasing	
Concrete & Cement	963	Increasing	
Non-Metallic Minerals	911	Increasing	
Farm Products	311	Decreasing	
Asphalt, Tar & Pitch	189	Increasing	
Sand & Gravel	79	Decreasing	
All Commodities	3,805	Increasing	
O&M Cost per Ton		$ 0.32[4]	
Growth Rates			Although not specifically forecasted, tonnage traffic at Milwaukee Harbor is expected to increase.
Coal		50.1%	
Concrete & Cement		45.7%	
Non-Metallic Minerals		-20.6%	
Farm Products		-13.2%	
Asphalt, Tar & Pitch		15.2%	
Sand & Gravel		-18.6%	
All Commodities		12.8%	
Vessel Types	Bulk	Bulk	No change.
Vessel Sizes	Class 3-8, mainly class 5 & 8.	Increased use of Class 8s, decreased use of shallow barges.	No change.
Vessel Operations	Utilizing maximum channel depth, continued use of light loading.	No change.	No change.

[1] Includes only pertinent indicators.
[2] Based on vessel traffic from *Waterborne Commerce of the United States. Part 3-Great Lakes*. Calendar Year 2005. Reported in thousands of tons.
[3] Period considered is 2001 through 2005.
[4] Period considered is 1995 through 2006.

Cost Indicators

Maintenance Cost History- Dredging records report quantities dredged at Milwaukee Harbor beginning in 1957, however the records for many of the years prior to 1976 are missing dredging costs. 1976 is also a prominent year in these records because that was the first year in which the existing Confined Disposal Site (CDF) was first used for disposal of dredged material. Therefore, Table C-8 reports the dredging quantities and costs beginning in 1976 to the latest year in which Milwaukee Harbor was dredged, 2001. Note that the cost of dredging includes transportation to and placement in the CDF.

Table C-8
CDF Construction and
Maintenance Dredging Costs
1975 – 2001
(in FY07 dollars[1])

CONSTRUCTION HISTORY			
1975	CDF Construction	$ 22,062,256	
DREDGING HISTORY[2]			
	Cubic Yard	**Cost**	**Cost per CY**
1976	465,833	$ 4,575,274	$ 9.83
1977	125,000	$ 445,040	$ 3.55
1978	208,389	$ 2,602,168	$ 12.50
1981	188,401	$ 1,270,606	$ 13.74
1987	307,656	$ 2,687,226	$ 8.73
1990	134,387	$ 526,676	$ NA
1993	108,067	$ 756,982	$ 7.01
1995	18,934	$ 280,016	$ 14.79
1999	54,259	$ 720,525	$ 13.28
2001	1,218	$ 26,426	$ 21.69
TOTAL	1,612,144	$ 13,890,939	

1 Updated using Civil Works Constuction Cost Index System
2 Source: USACE Detroit District Website http://www.lre.usace.army.mil

Table C-9 presents the maintenance cost history across several cost categories for the last six years. Several shortcomings exist with the reported data. No Operations and Maintenance (O&M) has been needed at the CDF in approximately 15 years. Dredging at the Project last took place 6 years ago. This was an unusual dredging situation in that an abnormally small amount of material was removed, therefore the cost is not truly representative of normal dredging. Also, as with the above table, the cost of dredging includes transportation to and placement in the CDF. Separable costs for each of these activities were not available. Finally, an environmental study has only been performed once at the Harbor during the last 5 years. Combined, all these factors lead to an abnormally low average maintenance cost over the last 5 to 6 years.

Table C-9
Maintenance Cost History
(in FY07 dollars[1])

Reach or Segment	**Construction/ Acquisition**		**Dredging Costs (dollars per year)**							
	Year	Cost		2001	2002	03	04	05	06	Average
Whole Project	1975	$27,349,780	Dredg	$ 28,736	-0-	-0-	-0-	-0-	-0-	
			Transpo r-tation	Included Above.	-0-	-0-	-0-	-0-	-0-	
			Placeme nt	Included Above.	-0-	-0-	-0-	-0-	-0-	
			Env. Studies	-0-	$ 47,934	-0-	-0-	-0-	-0-	
			Disposa l Site O&M	-0-	-0-	-0-	-0-	-0-	-0-	-0-
			Total	$ 28,736	$ 47,934	-0-	-0-	-0-	-0-	$12,778

[1] Updated using Civil Works Constuction Cost Index System

<u>Maintenance Cost Projections</u> - The existing CDF has remaining capacity of approximately 200,000 CY. Maintenance dredging of roughly 50,000 CY is scheduled for the summer of FY07. Also, the Environmental Protection Agency (EPA) plans to dispose of approximately 176,000 CY in FY08. By the end of FY08, the existing CDF will have zero capacity.

The estimated cost for the construction of the Dredged Material Disposal Facility (DMDF) is detailed in Table C-10. All amounts are presented in FY09 dollar levels. As construction would occur within a single construction season, no interest during construction was estimated. Finally, the annualized average cost of constructing the DMDF is calculated by amortizing the Total Construction Costs over the 20-year life of the Project utilizing the FY08 Federal Discount rate of 4.875%.

Table C-10
Dredged Material Disposal Facility
Construction Costs [1]

Features	Quantity	Unit Amount	Total Amount
Construction			
Mobilization & Demobilization			$ 148,045
Compacted Fill	71,000 cy	$ 11.47	$ 831,472
Riprap - Armor Stone	10,500 tn	$ 69.64	$ 746,576
Crushed Aggregate	5,000 cy	$ 36.28	$ 185,209
Geotextile	20,000 sy	$ 4.11	$ 83,926
Portland Cement	703 tn	$ 178.61	$ 128,200
Site Restoration			$ 14,804
Load/Transport Material	71,000 cy	$ 10.86	$ 787,252
Subtotal Construction			**$ 2,925,484**
Engineering & Design	6%		$ 175,529
S&A	9%		$ 263,294
Contracting & Award			$ 10,000
EDDC	1%		$ 29,255
Subtotal Non-Construction			$ 478,078
Contingency	15%		$ 71,712
Subtotal Non-Construction			**$ 549,790**
Total First Costs [2]			**$ 3,475,274**
Annualized Average Cost [3]			**$ 275,917**
Annual O&M Cost			**$ 12,000**
Total Annualized Average Cost			**$ 287,917**

[1] Presented in FY 2009 dollars.
[2] As construction will occur during a single season, no interest during construction was estimated.
[3] Amortized over the 20-year project life using the FY08 discount rate of 4.875%.

Table C-11 presents the projected dredging maintenance costs for Milwaukee Harbor over the next 20 years. According to the Detroit District's 5-year Plan, Milwaukee Harbor will be dredged in FY07 and again in FY11. After FY11, Detroit District will dredge the Harbor approximately every four years. The costs of each dredging occurrence after FY11 was derived by averaging the estimated costs of dredging in

FY07 and FY11. As above, the cost of transportation and placement of the dredged material is included in the dredging costs. Environmental sampling and assessment will be performed in FY07 and again in FY11.

This analysis assumes that sampling will occur every four years as well and that the cost remain constant throughout the 20-year period of analysis. Dredging and environmental sampling costs are presented in FY07 dollar values. As the proposed DMDF will have a pump to aid in dewatering the dredged material, there will be an annual O&M cost of $12,000.

Table C-11
Maintenance Cost Projections
(in thousands of FY07 dollar)

Year	Construction	Dredging	Envir. Samp.	Total	Total Plus O&M
2007		$750	$50	$800	$800
2008				$0	$0
2009	$3,314[1]			$3,314	$3,326
2010				$0	$12
2011		$661	$41	$703	$715
2012				$0	$12
2013				$0	$12
2014				$0	$12
2015		$530	$34	$564	$576
2016				$0	$12
2017				$0	$12
2018				$0	$12
2019		$438	$28	$466	$478
2020				$0	$12
2021				$0	$12
2022				$0	$12
2023		$362	$23	$385	$397
2024				$0	$12
2025				$0	$12
2026				$0	$12
Total	$3,314	$2,741	$176	$6,232	$6,448
Annualized Average	**$263**	**$218**	**$14**	**$495**	**$512**

[1] DMDF project costs discounted to 2007 dollar values.

Economic Justification

Milwaukee Harbor currently ships and receives approximately 3.8 million tons of commodities annually. The Harbor has experienced an increasing trend, 1.3 million tons or 52.2%, in commodity traffic over the past 14 years. Increasing rail congestion suggests that commodity traffic can be expected to increase moderately in future years.

The fleet servicing the Harbor demonstrates a desire to decrease the number of shallow-depth vessels and maximize vessel draft to the authorized channel depth. Doing so, reduces the number of needed trips, thereby increasing shippers' savings, a NED benefit. In 2006, the U.S. Army Corps of Engineers, Buffalo District performed an analysis to ascertain the increased cost to shippers resulting from increased depth. Corps personnel utilized a model called GLLAPOM (Great Lake Level Analysis of Port Operation and Maintenance). This model is designed to simulate the shipping costs associated with the most recent yearly waterborne shipments at varying hypothetical constrained port channel depths. GLLAPOM simulates each vessel movement for a given historical shipment list at a port of interest and determines the maximum tons the vessel can carry given water column constraints. Decreases in available water column lead to light loading and the need to make more round trips to carry the same yearly tonnage levels. The increased time necessary to move all of the historical cargo tonnages needed results in higher transportation costs.

Results from the model indicate that at one foot above the authorized depth at Milwaukee Harbor, indicating one foot of shoaling, transportation costs per ton increase by approximately $0.24. At two feet above authorized depth, per ton costs increase by approximately $0.57. Using 3.3 million tons, the average of the last 12 years of commodity traffic, such shoaling would cause total cost increases of $792,000 and $1.88 million, respectively. However it should be noted that GLLAPOM assumes that the originators and receivers of cargo will bring in the same amount of cargo regardless of the increased costs. In many cases, originators or receivers ship less when costs exceed a certain point. Therefore, these cost increase estimates are likely biased upward. Yet, the model does indicate that NED benefits are reduced by lack of maintenance dredging.

The TVA analysis previously mentioned supports another justification for continued maintenance at Milwaukee Harbor. Results specific to the Harbor indicate that transporting one ton of a commodity via water is approximately $23.26 cheaper than land transportation. As previously noted, assumptions regarding static origin and destination points biases this estimate upward. However, when compared to the average O&M cost per ton, estimated in Table 3, of $0.32, it is clear that the benefit of continued maintenance outweighs the costs.

The current CDF will have zero remaining capacity at the end of FY08. In absence of this facility, the only other options are to either haul the contaminated material to the nearest CDF, located approximately 100 miles away in Green Bay, or to cease dredging. The former would dramatically increase costs, so the most likely scenario is that dredging at Milwaukee Harbor would cease. This would lead to shoaling that would force vessels to light load, eroding NED benefits i.e. increasing transportation costs.

An examination of the available evidence yields the conclusion that continued maintenance dredging at Milwaukee Harbor is justified.

Works Cited

Great Lakes – St. Lawrence Seaway New Cargoes/ New Vessels Market Assessment Report, January 2007. Prepared by TEMS, inc and Rand Corporation for the U.S. Department of Transportation and Transport Canada.

Transportation Rate Analysis: Great Lakes and St Lawrence Seaway 2005. August 2005. Prepared by The Tennessee Valley Authority Navigation and Hydraulic Engineering Knoxville, Tennessee for U.S. Army Corps of Engineers
Huntington District Inland Navigation Planning Center